

16. [Algebra - Expansion]

Skill 16.1 Expanding brackets in expressions like $2(a + 1)$

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MMLime 11 22 33 44

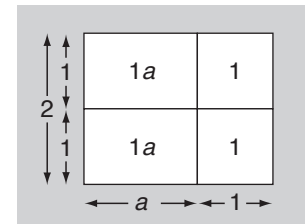
- Multiply the number outside the brackets by every term inside the brackets.
- Keep the sign from inside the brackets.

Expand the brackets

$$2(a + 1) = 2 \cdot a + 2 \cdot 1$$

Keep the sign

$$= 2a + 2$$



Q. Expand $5(2 - b)$

A. $5(2 - b)$
 $= 5 \cdot 2 - 5 \cdot b$
 $= 10 - 5b$

a) Expand $3(4b - 5)$

Expand the brackets

$$= 3 \cdot 4b - 3 \cdot 5 = 12b - 15$$

Keep the sign

b) Expand $2(z + 4)$

$$= 2 \cdot z + 2 \cdot 4 = \boxed{}$$

c) Expand $3(5 + w)$

$$= \dots = \boxed{}$$

d) Expand $7(n - 2)$

$$= \dots = \boxed{}$$

e) Expand $9(4 - u)$

$$= \dots = \boxed{}$$

f) Expand $5(e - 8)$

$$= \dots = \boxed{}$$

g) Expand $8(1 + 2a)$

$$= \dots = \boxed{}$$

h) Expand $4(2g - 6)$

$$= \dots = \boxed{}$$

i) Expand $2(2k - 3)$

$$= \dots = \boxed{}$$

j) Expand $9(2h + 3)$

$$= \dots = \boxed{}$$

k) Expand $3(4 - 6w + 4x)$

$$= \dots = \boxed{}$$

l) Expand $2(5 - 7d + 4e)$

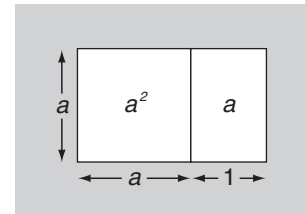
$$= \dots = \boxed{}$$

- Multiply the variable outside the brackets by every term inside the brackets.
- Keep the sign from inside the brackets.

Expand the brackets

$$a(a + 1) = a \cdot a + a \cdot 1$$

Keep the sign

$$= a^2 + a$$


Q. Expand $k(k - 6)$

A. $k(k - 6)$
 $= k \cdot k - k \cdot 6$
 $= k^2 - 6k$

a) Expand $a(2 - 2a)$

Expand the brackets

$$= a \cdot 2 - a \cdot 2a = 2a - 2a^2$$

Keep the sign

b) Expand $e(e + 4)$

$$= e \cdot e + e \cdot 4 = \boxed{}$$

c) Expand $r(9 + r)$

$$= \dots = \boxed{}$$

d) Expand $s(5 - s)$

$$= \dots = \boxed{}$$

e) Expand $d(d + 3)$

$$= \dots = \boxed{}$$

f) Expand $e(e - 7)$

$$= \dots = \boxed{}$$

g) Expand $a(1 + 2a)$

$$= \dots = \boxed{}$$

h) Expand $d(5d + 6)$

$$= \dots = \boxed{}$$

i) Expand $p(4 + 2p)$

$$= \dots = \boxed{}$$

j) Expand $z(6 - 6z)$

$$= \dots = \boxed{}$$

k) Expand $s(7t - 4s - 8)$

$$= \dots = \boxed{}$$

l) Expand $e(f + 4 - 9e)$

$$= \dots = \boxed{}$$

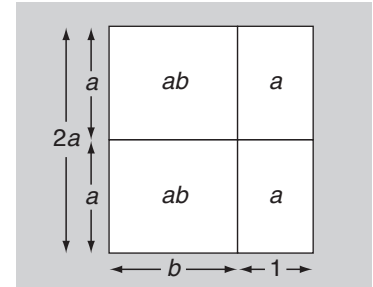
- Multiply the term outside the brackets by every term inside the brackets.
- Keep the sign from inside the brackets.

Expand the brackets

$$2a(b + 1) = 2a \cdot b + 2a \cdot 1$$

Keep the sign

$$= 2ab + 2a$$



Q. Expand $2x(x - 7)$

A. $2x(x - 7)$
 $= 2x \cdot x - 2x \cdot 7$
 $= 2x^2 - 14x$

a) Expand $2d(3d + 6)$

Expand the brackets

Keep the sign

$$= 2d \cdot 3d + 2d \cdot 6 = 6d^2 + 12d$$

b) Expand $3a(a - 5)$

$$= 3a \cdot a - 3a \cdot 5 = \boxed{}$$

c) Expand $5s(2 - 4s)$

$$= \dots = \boxed{}$$

d) Expand $3y(4y - 3)$

$$= \dots = \boxed{}$$

e) Expand $3k(5 + 2k)$

$$= \dots = \boxed{}$$

f) Expand $5g(2g - 4)$

$$= \dots = \boxed{}$$

g) Expand $4d(2d + 3)$

$$= \dots = \boxed{}$$

h) Expand $3a(7 + 2a)$

$$= \dots = \boxed{}$$

i) Expand $2q(6 - 2r)$

$$= \dots = \boxed{}$$

j) Expand $4i(6j + 4)$

$$= \dots = \boxed{}$$

k) Expand $7p(4p + q)$

$$= \dots = \boxed{}$$

l) Expand $5n(m - 5n)$

$$= \dots = \boxed{}$$

- Multiply the negative term outside the brackets by every term inside the brackets.
- Use the sign rules: $+++ = +$ $--- = +$ $+- = -$ $-+ = -$ (see skill 8.3, page 87)

Expand the brackets

$$-2a(b + 1) = (-2a) \cdot b + (-2a) \cdot 1$$

The \cdot sign can be left out

$$= -2ab - 2a$$

Use the sign rules

Q. Expand $-2(x - 4)$

A. $-2(x - 4)$
 $= (-2) \cdot x - (-2) \cdot 4$
 $= -2x + 8$

a) Expand $-5m(m + 4)$

Expand the brackets

$$= (-5m) \cdot m + (-5m) \cdot 4 = -5m^2 - 20m$$

+ - = -

b) Expand $-4(f + 3)$

$$= (-4) \cdot f + (-4) \cdot 3 = \boxed{}$$

c) Expand $-(b + 9)$

$$= \dots = \boxed{}$$

d) Expand $-3(r + 6)$

$$= \dots = \boxed{}$$

e) Expand $-8a(a - 2)$

$$= \dots = \boxed{}$$

f) Expand $-2w(3 + 4w)$

$$= \dots = \boxed{}$$

g) Expand $-7q(q + 3)$

$$= \dots = \boxed{}$$

h) Expand $-6b(4 - 5b)$

$$= \dots = \boxed{}$$

i) Expand $-2cd(2 - 3d)$

$$= \dots = \boxed{}$$

j) Expand $-tu(5t + 2u)$

$$= \dots = \boxed{}$$

k) Expand $-2s(8st + 3t)$

$$= \dots = \boxed{}$$

l) Expand $-3m(6mn - 4n)$

$$= \dots = \boxed{}$$

- Multiply the term outside the brackets by every term inside the brackets.
- Group like terms. (see skills 14.3, page 156 and 14.4, page 157)
- Use the sign rules: $++=+$ $--=+$ $+-=-$ $-+=-$ (see skill 8.3, page 87)

Q. Expand and simplify
 $2(ef - 5) + 4(ef + 3)$

A. $2(ef - 5) + 4(ef + 3)$ Expand the brackets

$$= \underline{2ef - 10} + \underline{4ef + 12}$$

Group like terms

$$= \underline{2ef + 4ef} - 10 + 12$$

$$= \underline{6ef} + 2$$

a) Expand and simplify
 $2(8c + 4) - 7c$ Expand the brackets

$$= \underline{16c + 8} - 7c$$

Group like terms

$$= \underline{16c - 7c} + 8 = \boxed{9c + 8}$$

b) Expand and simplify
 $3(2x + 1) + 4x$

$$= \underline{6x + 3} + 4x$$

$$= \underline{\hspace{2cm}} = \boxed{\hspace{2cm}}$$

c) Expand and simplify
 $2(x + 1) - 4x$

$$= \underline{\hspace{2cm}}$$

$$= \underline{\hspace{2cm}} = \boxed{\hspace{2cm}}$$

d) Expand and simplify
 $4s + s(2s - 5)$

$$= \underline{\hspace{2cm}}$$

$$= \underline{\hspace{2cm}} = \boxed{\hspace{2cm}}$$

e) Expand and simplify
 $3p(q - 6) + 4p$

$$= \underline{\hspace{2cm}}$$

$$= \underline{\hspace{2cm}} = \boxed{\hspace{2cm}}$$

f) Expand and simplify
 $5z(y + 3) - 8z$

$$= \underline{\hspace{2cm}}$$

$$= \underline{\hspace{2cm}} = \boxed{\hspace{2cm}}$$

g) Expand and simplify
 $5(hi - 3) - 8(hi + 3)$

$$= \underline{\hspace{2cm}}$$

$$= \underline{\hspace{2cm}} = \boxed{\hspace{2cm}}$$

h) Expand and simplify
 $n(n - 5) + 3(2n + 7)$

$$= \underline{\hspace{2cm}}$$

$$= \underline{\hspace{2cm}} = \boxed{\hspace{2cm}}$$

i) Expand and simplify
 $2b(b - 5) - 8(b - 5)$

$$= \underline{\hspace{2cm}}$$

$$= \underline{\hspace{2cm}} = \boxed{\hspace{2cm}}$$

j) Expand and simplify
 $a(bc + 4) - 3(2a + 5)$

$$= \underline{\hspace{2cm}}$$

$$= \underline{\hspace{2cm}} = \boxed{\hspace{2cm}}$$

Skill 16.6 Expanding and simplifying more complex expressions.

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MMLime 1 1 2 2 3 3 4 4

- Multiply the term outside the brackets by every term inside the brackets.
- Group like terms. (see skills 14.3, page 156 and skill 14.4, page 157)
- Use the sign rules: $++=+$ $--=+$ $+-=-$ $-+=-$ (see skill 8.3, page 87)

Q. Expand and simplify
 $-2(t^2 - u) + 5t(t - 3)$

A. $-2(t^2 - u) + 5t(t - 3)$ Expand the brackets
 $= -2t^2 + 2u + 5t^2 - 15t$ Group like terms
 $= -2t^2 + 5t^2 + 2u - 15t$
 $= 3t^2 + 2u - 15t$

a) Expand and simplify
 $-4a(a - 2) + 7(a^2 - b)$ Expand the brackets
 $= -4a^2 + 8a + 7a^2 - 7b$
 $= -4a^2 + 7a^2 + 8a - 7b = 3a^2 + 8a - 7b$ Group like terms

b) Expand and simplify
 $x(2x + 3) - 3(x + 7)$
 $= 2x^2 + 3x - 3x - 21$
 $=$

c) Expand and simplify
 $3(2t - 4) + t(t - 2)$
 $=$
 $=$

d) Expand and simplify
 $-2s(5s^2 + 3s) + (s - s^2)$
 $=$
 $=$

e) Expand and simplify
 $tu(t - 1) + 8u(t^2 - t)$
 $=$
 $=$

f) Expand and simplify
 $3e(f - e) + 8e(f^2 - e)$
 $=$
 $=$

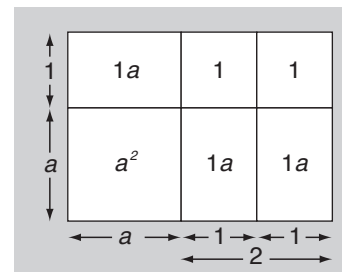
g) Expand and simplify
 $-6kl(k - 2) - 2l(2k^2 - 2k)$
 $=$
 $=$

h) Expand and simplify
 $-5m(m - 1) + 6(m^2 - 1)$
 $=$
 $=$

i) Expand and simplify
 $-8y(xy - 1) + 4xy(x + 2y)$
 $=$
 $=$

j) Expand and simplify
 $-3(q^2 + q) + 4q(q + 1)$
 $=$
 $=$

- Multiply each term inside the first set of brackets by each term inside the second set of brackets.
- Simplify the products.
- Group like terms. (see skills 14.3, page 156 and skill 14.4, page 157)
- Use the sign rules: $++=+$ $--=+$ $+--=-$ $-+-=-$
(see skill 8.3, page 87)



Expand the brackets $(a + 1)(a + 2) = a \cdot a + a \cdot 2 + 1 \cdot a + 1 \cdot 2$
 $= a^2 + 2a + a + 2$
 $= a^2 + 3a + 2$

Simplify the products
 Group like terms

Q. Expand and simplify $(w - 3)(w - 2)$

A. $(w - 3)(w - 2) = w \cdot w + w \cdot (-2) + (-3) \cdot w + (-3) \cdot (-2)$
 $= w^2 - 2w - 3w + 6$
 $= w^2 - 5w + 6$

Expand the brackets
 Simplify the products
 Group like terms

a) Expand and simplify $(h - 5)(h + 2)$

$= h \cdot h + h \cdot 2 + (-5) \cdot h + (-5) \cdot 2$
 $= h^2 + 2h - 5h - 10 = h^2 - 3h - 10$

b) Expand and simplify $(x + 3)(x + 1)$

$= x \cdot x + x \cdot 1 + 3 \cdot x + 3 \cdot 1$
 $= \dots = \dots$

c) Expand and simplify $(w + 4)(w - 3)$

$= \dots$
 $= \dots = \dots$

d) Expand and simplify $(u + 4)(5 - u)$

$= \dots$
 $= \dots = \dots$

e) Expand $(f - 2)(g + 8)$

$= \dots$
 $= \dots = \dots$

f) Expand $(j - 5)(k - 3)$

$= \dots$
 $= \dots = \dots$

g) Expand and simplify $(2h - 4)(h + 5)$

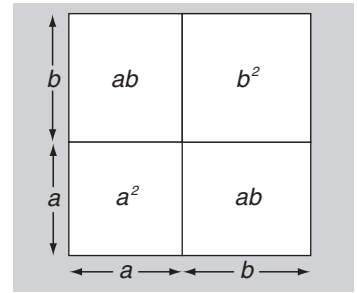
$= \dots$
 $= \dots = \dots$

h) Expand and simplify $(2r + 6)(3r - 7)$

$= \dots$
 $= \dots = \dots$

Skill 16.8 Expanding brackets in perfect squares like $(a + b)^2$

- Multiply each term inside the first set of brackets by each term inside the second set of brackets.
- Simplify the products.
- Group like terms. (see skills 14.3, page 156 and skill 14.4, page 157)



OR

- Substitute values into the perfect square formula
 $(a + b)^2 = a^2 + 2ab + b^2$

Expand the brackets

$$(a + b)^2 = (a + b)(a + b) = \overset{1}{a} \cdot \overset{2}{a} + \overset{2}{a} \cdot \overset{3}{b} + \overset{3}{b} \cdot \overset{4}{b} + \overset{4}{b} \cdot \overset{1}{a}$$

$$= \overset{1}{a^2} + \overset{2}{ab} + \overset{3}{ba} + \overset{4}{b^2}$$

Simplify the products

$$= \overset{1}{a^2} + \overset{2}{2ab} + \overset{3}{b^2}$$

Group like terms

<p>Q. Expand and simplify $(n + 9)^2$</p>	<p>A. $(n + 9)^2$ $= (n + 9)(n + 9)$ $= \overset{1}{n} \cdot \overset{2}{n} + \overset{2}{n} \cdot \overset{3}{9} + \overset{3}{9} \cdot \overset{4}{n} + \overset{4}{9} \cdot \overset{1}{9}$ $= n^2 + 9n + 9n + 81$ $= n^2 + 18n + 81$</p>	<p>OR $(n + 9)^2$ Using $a^2 + 2ab + b^2$ where $a = n$ and $b = 9$ $= n^2 + 2 \cdot n \cdot 9 + 9 \cdot 9$ $= n^2 + 18n + 81$</p>
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a) Expand and simplify $(s + 4)^2$

$a^2 + 2ab + b^2$ where $a = s$ and $b = 4$

$$= \overset{1}{s^2} + \overset{2}{2 \cdot s \cdot 4} + \overset{3}{4^2} = \boxed{s^2 + 8s + 16}$$

b) Expand and simplify $(y + 1)^2$

$$= \dots$$

$$= \dots = \boxed{}$$

c) Expand and simplify $(h + 2)^2$

$$= \dots$$

$$= \dots = \boxed{}$$

d) Expand and simplify $(t + 6)^2$

$$= \dots$$

$$= \dots = \boxed{}$$

e) Expand and simplify $(p + 7)^2$

$$= \dots$$

$$= \dots = \boxed{}$$

f) Expand and simplify $(m + 5)^2$

$$= \dots$$

$$= \dots = \boxed{}$$

g) Expand and simplify $(r + 8)^2 + 4$

$$= \dots$$

$$= \dots = \boxed{}$$

h) Expand and simplify $(g + 3)^2 - 3g$

$$= \dots$$

$$= \dots = \boxed{}$$

- Multiply each term inside the first set of brackets by each term inside the second set of brackets.
- Simplify the products.
- Group like terms. (see skills 14.3, page 156 and skill 14.4, page 157)
- Use the sign rules: $++=+$ $--=+$ $+--=-$ $-+-=-$ (see skill 8.3, page 87)

OR

- Substitute values into the perfect square formula $(a - b)^2 = a^2 - 2ab + b^2$

Expand the brackets

$$(a - b)^2 = (a - b)(a - b) = \overset{1}{a} \cdot \overset{2}{a} + \overset{2}{a} \cdot \overset{3}{(-b)} + \overset{3}{(-b)} \cdot \overset{1}{a} + \overset{3}{(-b)} \cdot \overset{4}{(-b)}$$

$$= \overset{1}{a^2} - \overset{2}{ab} - \overset{3}{ba} + \overset{4}{b^2}$$

Simplify the products

$$= a^2 - 2ab + b^2$$

Group like terms

<p>Q. Expand and simplify $(n - 3)^2$</p>	<p>A. $(n - 3)^2$ $= (n - 3)(n - 3)$ $= \overset{1}{n} \cdot \overset{1}{n} + \overset{2}{n} \cdot \overset{3}{(-3)} + \overset{3}{(-3)} \cdot \overset{1}{n} + \overset{3}{(-3)} \cdot \overset{3}{(-3)}$ $= n^2 - 3n - 3n + 9$ $= n^2 - 6n + 9$</p>	<p>OR $(n - 3)^2$ Using $a^2 - 2ab + b^2$ where $a = n$ and $b = 3$ $= n^2 - 2 \cdot n \cdot 3 + 3 \cdot 3$ $= n^2 - 6n + 9$</p>
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a) Expand and simplify $(s - 4)^2$

$a^2 - 2ab + b^2$ where $a = s$ and $b = 4$

$$= s^2 - 2 \times s \times 4 + 4^2 = s^2 - 8s + 16$$

b) Expand and simplify $(k - 1)^2$

$$= \dots = \dots = \dots$$

c) Expand and simplify $(m - 2)^2$

$$= \dots = \dots = \dots$$

d) Expand and simplify $(q - 5)^2$

$$= \dots = \dots = \dots$$

e) Expand and simplify $(j - 7)^2$

$$= \dots = \dots = \dots$$

f) Expand and simplify $(e - 9)^2$

$$= \dots = \dots = \dots$$

g) Expand and simplify $(z - 6)^2 + 8$

$$= \dots = \dots = \dots$$

h) Expand and simplify $(b - 4)^2 - 3b$

$$= \dots = \dots = \dots$$